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Scientific Intelligence Report

Japanese Nuclear Energy Program

OSI - SR/64 - 55
18 November 1964

Office of Scientific Intelligence

APPROVED FOR RELEASE
JUN 9 1997

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Scientific Intelligence Report

JAPANESE NUCLEAR ENERGY PROGRAM

OSI/SR/64-55
16 November 1964

CENTRAL INTELLIGENCE AGENCY
Office of Scientific Intelligence

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Project Officer

[redacted]

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3.4(b)(1)

Brief

JAPANESE NUCLEAR ENERGY PROGRAM

Summary and Conclusions

The Japanese nuclear energy program is limited by law to peaceful purposes. Major applications to date have been the use of radioisotopes in research, medicine, and industry. Interest has been shown in nuclear marine propulsion and nuclear electric power. The first nuclear-propelled ship is being designed now. Current plans for power production are 1400 megawatts (electrical) by 1970. One station is now being built with British assistance.

[redacted]

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Discussion

Introduction

The Japanese nuclear energy program, which started in 1956, is based on a national policy for the development of the peaceful uses of nuclear energy. The Government has established an extensive nuclear research and development program; industry has made at least an equal effort in applied fields, and both are cooperating in programs for nuclear power and propulsion.

The shortage of funds and trained personnel and the lack of basic nuclear raw materials are being overcome by larger governmental appropriations and contributions from industry, establishment of training programs, and the importation of the necessary materials from other countries. Cooperation with other countries has particularly benefitted Japan in the construction of a number of research reactors and its first nuclear power reactor.

The major Governmental organizations are the Japan Atomic Energy Commission (JAEC) for planning; the Atomic Energy Board (AEB) for administration; and the Japan Atomic Energy Research Institute (JAERI), the Atomic Fuel Corporation (AFC), both at Tokai-mura, and the National Institute of Radiological Sciences (NIRS) at Chiba for research and development.

Research Reactors

Japan currently has 12 reactors in operation or under construction, 5 critical assemblies, 63 accelerators, over 70 installations for radiation research, and 17 facilities for fusion research. The major research site is JAERI, where most of the research reactors and a prototype power reactor have been constructed. All of the research reactors, except one, have been constructed with U.S. assistance and use enriched uranium fuel supplied by the United States. The one exception is the Japan Research Reactor-3 (JRR-3), a 10 megawatt (MW) natural-uranium-fueled, heavy-water-moderated reactor, which went critical on 13 September 1962. This reactor was constructed by the Japanese; however, Canada provided uranium for fuel through the IAEA and the United States supplied the heavy water -- both with safeguards. Construction of additional research

reactors is contemplated, but all those presently planned will require enriched fuel which Japan cannot provide.

Nuclear Materials

Extensive exploration for uranium has been conducted, but no substantial deposits of uranium have been discovered. Three areas have been found to contain low-grade deposits of uranium. The most promising area is Ningyo Pass, where mining has been started and construction of an ore concentration plant was begun in 1963-1964. Both AFC and industrial organizations have conducted considerable research to find an economic method to process the low-grade domestic ores. The AFC has a pilot plant for refining uranium and facilities for the production of uranium metal and fuel element fabrication.

While Japan has produced a limited amount of uranium, most of the fuel has been purchased from other countries. Over 25 tons of uranium concentrate have been purchased from Canada through the auspices of the IAEA. This concentrate has been processed into metal and fabricated into fuel elements by the Japanese. The natural uranium fuel for the first nuclear power station now under construction, will be supplied by the United Kingdom. About 750 tons of uranium metal are expected to be imported over the ten-year period at an estimated cost of $27.8 million. The United States has supplied about 24 tons of natural uranium and over 12 tons of enriched uranium with enrichment ranging from 1.5 percent to 90 percent. All of the uranium supplied by the United States, United Kingdom, and Canada is safeguarded.

For a number of years research has been conducted on the development of processes for the production of heavy water. Although pilot plants were constructed, the Japanese were unable to produce heavy water at a price comparable to that of the United States. Therefore, heavy water needed in the Japanese nuclear energy program has been obtained from the United States under safeguards. The Japanese have produced sufficient reactor-grade graphite for the research reactor program, but the amount required for the first nuclear power station was beyond domestic capability. The graphite for the British-supplied power reactor has been purchased from France. Most of the other basic materials for the nuclear energy

program either are produced in Japan or can be purchased from other countries through normal commercial channels.

Applications

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Only small quantities of plutonium can be produced by the research reactors in operation or under construction, but the British-supplied power reactor will be able to produce significant amounts of plutonium. [redacted]

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Research on plutonium has been carried out at both JAERI and AFC to study the use of plutonium for advanced reactors. Construction of a fuel reprocessing plant for the separation of plutonium at the AFC Tokai-mura site began in June 1964 and will not be completed until at least late 1965. The plant is expected to be able to process 0.7 to 1.0 tons of irradiated fuel per day and to handle several types of fuel and cladding.

Japan is interested in developing a method of isotope separation for the production of uranium-235 which would be less expensive under Japanese conditions than the gaseous diffusion process. In 1959 the Institute of Physical and Chemical Research began basic re-

search on the molecular distillation of uranium-235 and the ultracentrifuge process of isotope separation Two ultracentrifuge machines were constructed for developmental research. but nothing is known of this work since 1962 when it was transferred to AFC.

The major application of nuclear energy in Japan to date is the use of radioistopes in research. medicine. and industry. The principal organization for radiation research is the NIRS, but a number of governmental. educational, and industrial organizations also are conducting research using radioisotopes. A considerable quantity of radioisotopes are used for gauging, process control, and nondestructive testing by industry. By 1963, industry had invested over $15 million directly in isotope work. About one-third of this amount is used for industrial production while the other two-thirds is used for research.

Considerable interest has been shown in developing nuclear propulsion. Since 1956. conceptual designs of more than 20 nuclear propelled ships have been made. In 1963, the Nuclear Ship Development Corporation was established to construct the first Japanese nuclear propelled ship -- an oceanographic research vessel. The long-range program called for design of the ship to begin in 1963 and final testing to be completed in 1973. The present plan is for a 6.350 ton. 10,000 shaft horsepower ship powered by a light-water type reactor having a thermal power of 35 MW.

Japan possesses limited natural energy resources and a long-range plan for the development of nuclear power has been made which calls for the construction of 1.400 MW (electric) of nuclear electrical generating capacity by 1970. and 6,000 to 8,500 MW (electric) by 1980. Japan Atomic Power Company, Ltd. (JAPCO), a joint governmental and industrial company. was established in 1957, and a contract for the construction of Japan's first nuclear power station was concluded with Great Britain in December 1959. Construction of this station, called the Tokai Nuclear Power Station, was started in 1959 at Tokai-mura and is expected to be in operation in 1965. The power station consists of one reactor of the British Calder Hall type and will have an installed electric power capacity of 166 MW (electric). The second JAPCO nuclear power station is to have a U.S. light-water type reactor with an expected installed power capacity in the range of 250 to 300 MW (electric). The reactor probably will not be

in operation until at least 1970. In addition, three power companies have programs for the construction of nuclear power stations. These programs are still in the early stages of conceptual design, and the stations, if built, probably will not be in operation until 1970 or later.